Transceiver Preamplifier

MODEL P-312X

OPERATOR'S MANUAL

PALOMAR ENGINEERS

INSTRUCTIONS

All Band Preamplifier

The Palomar Engineers preamplifier may be added to most transceivers in the frequency range 1.8 to 54 MHz. It improves the gain, noise figure, spurious signal and image rejection of the receiver section. This all-new preamplifier has been designed specifically for use with a transceiver. Its sophisticated control circuitry permits it to be added to virtually any transceiver without modification. This is accomplished by the use of automatic antenna switching inside the preamplifier. When the preamplifier senses transmitter RF power, it automatically switches out of the amplifier mode and connects the antenna directly to the transceiver.

The preamplifier uses a tuned RF amplifier, covering all the amateur bands from 160 through 6 meters and, in addition, all foreign broadcasts, as well as other services within this frequency range. It employs a low noise dual gate FET transistor, providing a noise figure of 1.5 to 3.5 db, over the frequency range 1.8 to 54 MHz. The preamplifier will be found especially effective with those transceivers employing the Pi-output network of the transmitter section as the receiver RF stage input. Many transceivers of this type begin to suffer a noticeable decrease in sensitivity on 15 meters, and especially on 10 meters. The preamplifier will be most beneficial on these bands. The inclusion of 6 meters makes it useable with 6 meter transceivers.

INSTALLATION

1. Connect your antenna to the "ANT 1" jack on the preamplifier rear panel.

2. Run a coaxial cable from your transceiver antenna jack to the "RCVR" jack on the preamplifier rear panel.

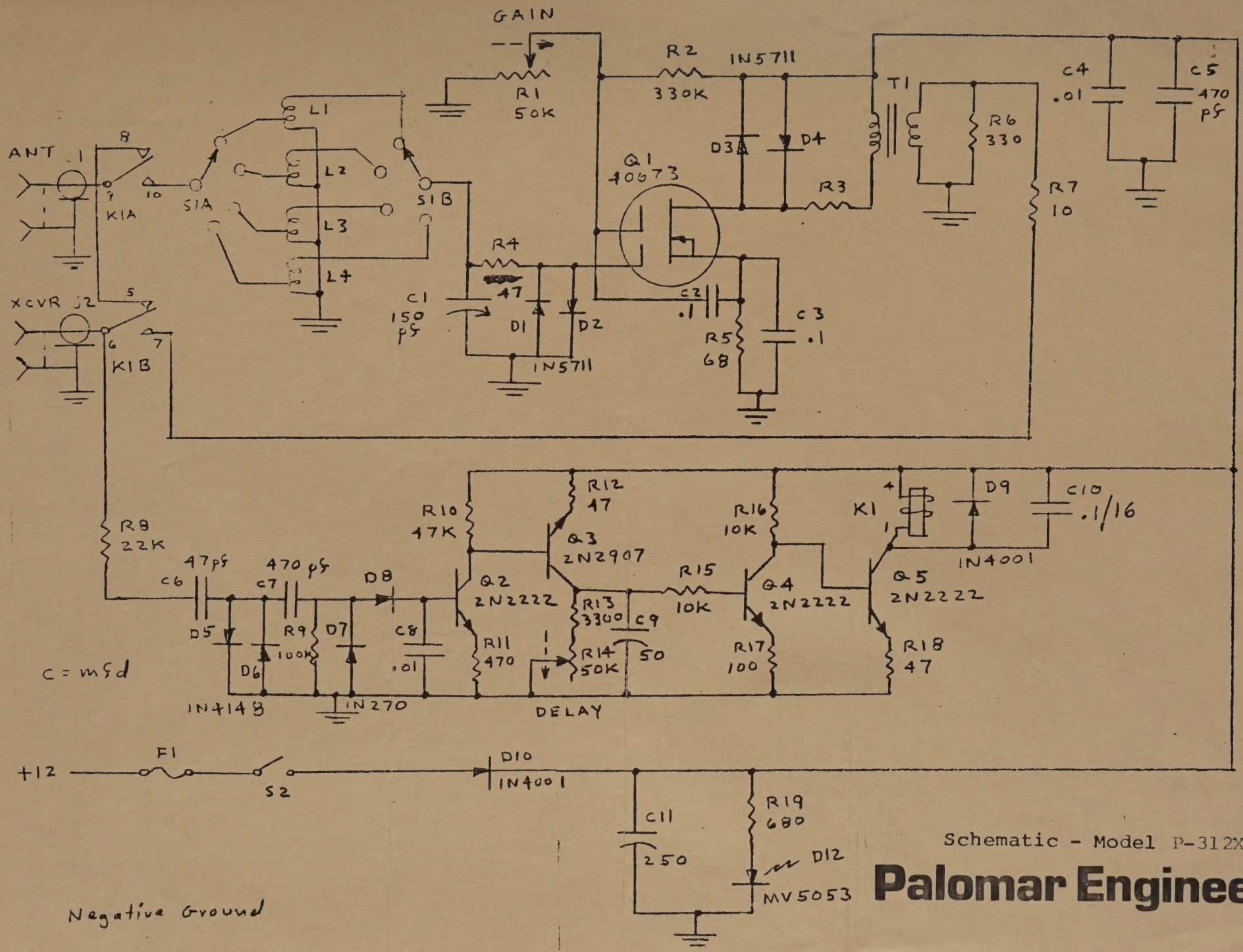
3. Run a strap from the rear ground terminal to car chassis. Connect red wire to +12 volts.

4. If you use a linear amplifier with the transceiver connect it between the preamplifier and the antenna. The maximum power that can run through the preamplifier is 350 watts peak. So, do not ever connect it to the output of your linear.

OPERATION

1. After installing the preamplifier as described above, and with the preamplifier power switch in OFF position, the transceiver is connected directly to the antenna. Tune in a signal on the desired frequency band.

2. Turn the BAND switch to a position that includes the desired frequency. Turn the DELAY switch clockwise. Peak the signal with the TUNE control. Set the GAIN control for the desired amplification. The preamplifier is now in operation.



Schematic - Model P-312X

Palomar Engineers

3. As soon as you start to transmit, the preamplifier cuts itself out of the circuit and the transceiver is connected directly to the antenna. After transmission stops there is a short delay, then the preamplifier cuts back in. The DELAY control sets the delay time. For CW and most SSB work it should be set full clockwise (maximum delay). For contest or net operation a shorter delay may be desired. The delay is continuously adjustable from about ½-second to over 3-seconds.

1590

Palomar Engineers

Box 455, Escondido, CA. 92025 • Phone: [714] 747-3343

Transceiver Preamplifier

Model P-410X
&
Model P-412X

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INSTRUCTIONS

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INSTALLATION

1. Connect your antenna to the ANTENNA jack on the preamplifier rear panel.

2. Run a coaxial cable from your transceiver antenna jack to the RECEIVER jack on the preamplifier rear panel.

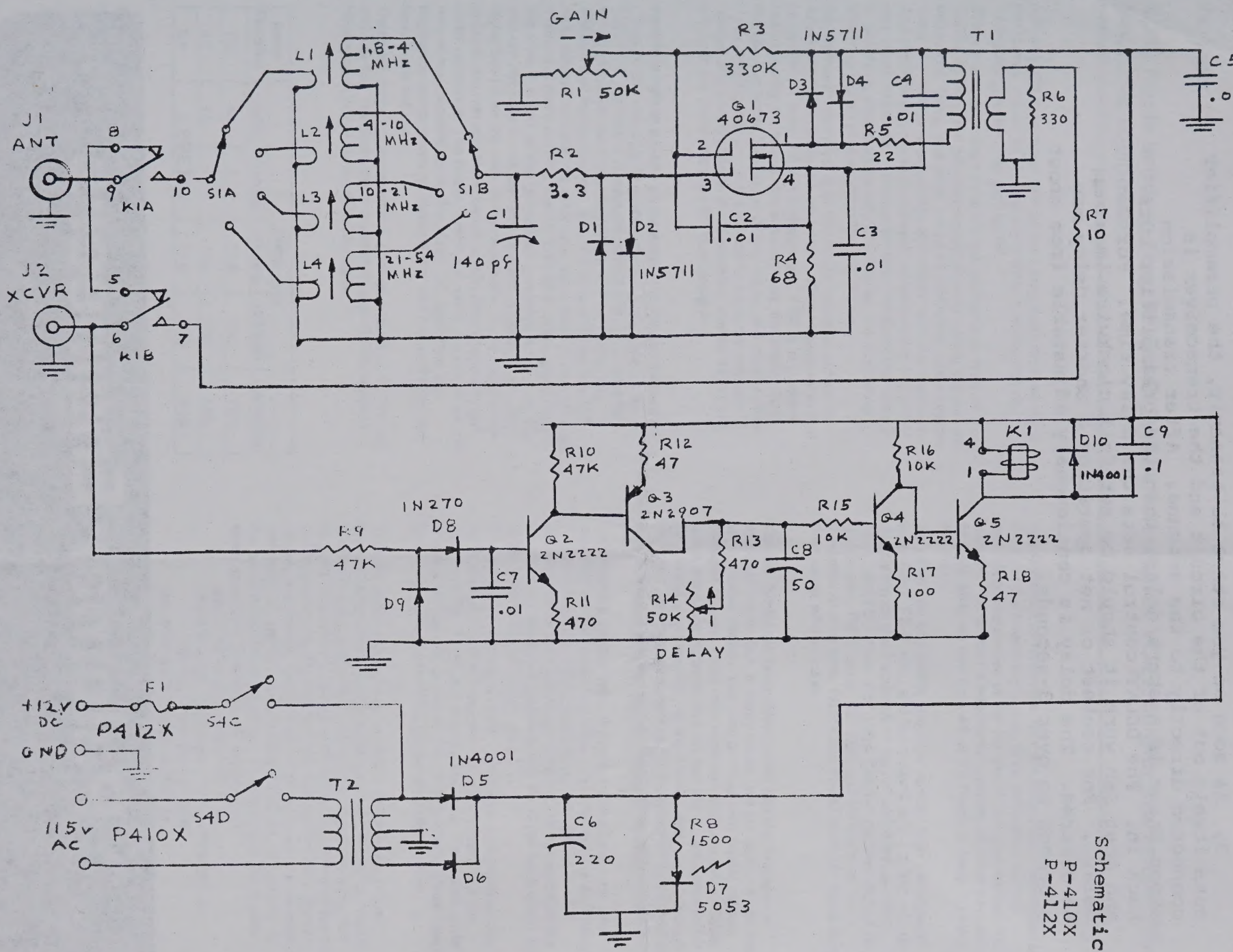
3. P-410X: Plug the power cord into a 117-v 60 Hz outlet. P-412X: Connect red power lead to +12-v DC. Ground rear post.

4. If you use a linear amplifier with the transceiver connect it between the preamplifier and the antenna. The maximum power that can run through the preamplifier is 350 watts peak. So, do not ever connect it to the output of your linear.

OPERATION

1. After installing the preamplifier as described above, and with the preamplifier power switch in OFF position, the transceiver is connected directly to the antenna. Tune in a signal on the desired frequency band.

2. Turn the BAND switch to a position that includes the desired frequency. Turn the DELAY switch clockwise. Peak the signal with the TUNE control. Set the GAIN control for the desired amplification. The preamplifier is now in operation.



Schematic
P-410X
P-412X

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Palomar Engineers

1924-F West Mission Road, Escondido, CA 92025 • Phone (619) 747-3343

RFI
Tip Sheet

Using Ferrite Beads to Keep RF Out Of TV Sets, Telephones, VCR's, Burglar Alarms and Other Electronic Equipment

RFI and TVI have been with us for a long time. Now we have microwave ovens, VCR's and many other devices that do wrong things when they pick up RF.

There are several ways to tackle the problem but most of them involve opening the affected equipment and adding suppressor capacitors, filters, and other circuit modifications. Unfortunately there is a serious disadvantage associated with this approach. Any modifications made to domestic entertainment equipment can — and often are — blamed for later problems that arise in it. Modifying your own equipment is not so bad, but taking a soldering iron to your neighbor's stereo is risky.

An alternative approach is to use ferrite beads to reduce the amount of RF entering the equipment. If the equipment is in a metal box, or even if it's in a plastic box, if RF is prevented from entering the box on the antenna lead, the power cable, the speaker leads, the phono pickup leads, and on any other wires entering the box, it is possible to solve the problem without any modification to the equipment. Ferrite beads just slip over the wires and stop RF from going in.

Ferrite beads are made of the same materials as the toroid cores used in broadband transformers but are used at much higher frequencies. For example, ferrite Mix 43 is used for tuned circuits in the frequency range .01 to 1 MHz. It is efficient and losses are low. But, if it is used in the 40-200 MHz range it is lossy. So when you slip a bead of Mix 43 over a wire and there is RF in the 40-200 MHz range going down the wire, it is just as though you put a resistor in the wire. But you did not have to cut the wire to insert a resistor; you just slip a bead over the wire. If the resistance of one bead is not enough you can add more beads or add longer beads to get more resistance. The beads, unlike a resistor, do not affect the wire at low frequencies so the audio, DC, and other low frequency components go through the wire just as though the bead were not there.

There are three bead materials in general use: Mix 73, Mix 43, and Mix 64. The impedance in ohms of size FB-18 beads vs frequency is shown in the following table.

Bead Material	Frequency				
	1-MHz	10-MHz	40-MHz	100-MHz	1000-MHz
73	45	110	110	110	120
43	15	70	110	150	160
64	6	40	110	160	400

From the table we see that beads of the three materials work about the same at 40 MHz where the impedance is 110 ohms.

Below 40 MHz material 73 is best. Above 40 MHz material 64 is best. For overall performance from 1-1000 MHz material 43 is the best choice.

It is important to remember that the frequencies mentioned are those of the interfering signals to be eliminated; not the operating frequencies of the equipment being protected. For example: To protect a telephone operating at voice frequencies of .002 MHz we use type 43 or 73 beads to keep 14 MHz RF out.

So when you buy beads you must specify both the physical size (FB-3, FB-8, etc.) and the material (Mix 73, Mix 43, etc.) depending on the frequency of the RF interference. FB-1, FB-3, and FB-7 have .05" holes that will slip over bare #18 guage wire. FB-8 has a .09" hole and will slip over the insulation of #22 wire. FB-24 and FB-63 have .2" holes to go over larger wire or cable.

Cables. So far we have talked about slipping beads over individual wires. But, in many cases, we are going to find two wire speaker cables, two wire or three wire power cables, twinlead antenna cable, and multi-wire control cables. Cable wires are close together and act just like a single wire as far as RF pickup is concerned. So the whole cable can go through the bead and this will suppress RF transmission through all the cable wires. This is a lot easier than putting beads on each wire.

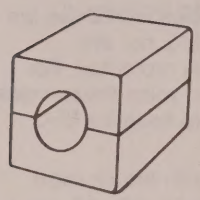
Twinlead is a special case. If you put a bead on each wire you'll kill the TV signal. But if the whole twinlead goes through a single bead, the TV signal goes on through but the RF interference is suppressed by the bead. This is because the twinlead is a transmission line to the TV signal but looks like a single wire to the RF interference.

This brings us to coaxial cable. The signal going through the coax is confined to the inside of the coax shield. But the outside of the shield acts just like any wire; it can pick up RF and that RF can be carried to the TV or monitor. Shield beads placed over the cable will suppress this interference.

Toroids. When we start talking about slipping beads over coaxial cable and multi-wire cable we see that we may need beads with pretty big holes. Also, if the cable has a molded plug on the end (like some power cords, for example) the plug has to go through the hole and we may need a very big hole indeed. Fortunately a variety of ferrite toroid cores are available with holes as big as 1.4" diameter. They are not available in all the same materials as beads but in similar ones. As a guide when specifying toroids for RF suppression:

Mix 77 is the best below 40 MHz
Mix 43 can be used from 1-1000 MHz and is the best from 30-150 MHz
Mix 61 is the best above 200 MHz

After you put that big plug through the toroid hole you'll find that the toroid fits the cable very loosely. Don't worry. It will still work fine. If there is room to do it, loop the cable around and run it through the toroid again. Do this as many times as you can. Each turn is just like adding another toroid. And, using the big Mix 61 cores, you add an inductive choke where two turns is four times as good as one turn, three turns is nine times as good, etc.



Split Beads. This is a new development to solve the problem of putting beads or toroids over cables that have big plugs on the end. They are beads that have been cut in half. You put the two halves over the cable and wrap them with tape to hold them together. The mating edges are polished smooth so the two halves mate very closely.

They are available with center holes of ¼" and ½" diameter. Also for flat computer cable 2 or 2½" wide.

It is important that the two halves of the split beads fit exactly together. So the ¼" hole beads cannot be used for cables larger than ¼". It does not matter if the cable is smaller than the hole.

All split beads now available are of 43 material which is the best overall material for 1-1000 MHz interference suppression.

Telephone Interference. The standard telephone is highly susceptible to RFI. The telephone wiring in the house and outside on poles make a large receiving antenna. And in the telephone instrument are voltage-variable resistors that act like detector diodes so nearby radio stations are clearly heard. The solution is to keep RF out of the telephone by putting ferrite beads on the telephone cable as it enters the instrument.

The plug of modular telephones will go through F82 toroids. Or ¼" split beads can be put over the cable.

Burglar Alarms. These are much like telephones in that they have extensive wiring throughout the building that acts like an antenna to pick up RF. The solution is the same: Use beads or toroids on the wires entering the electronics box to keep RF out. It also may be necessary to put beads on the 115-v AC power cord.

VCR's. The VCR is a real RFI problem. Ferrite beads on all wires entering the VCR can eliminate RFI from most amateur bands. But on 80 meters even this doesn't always work. W6BIP has worked on this problem; see **Ham Radio Magazine** October 1984 p. 113.

We have been talking about keeping RF *out* of equipment. You can also use beads and toroids to keep RF *in*. That fish tank heater that makes all that racket on 80 meters is using its power cord and the house power wiring to radiate interference. A bead or toroid on the power cord right at the heater can keep the noise from entering the wiring. Computer power cords and connecting cables can be treated in the same manner. Sometimes RF comes out of a transceiver's power cable. A toroid can stop it. Or RF flows on the outside of the antenna cable, going right around your lowpass filter. Again, toroids to the rescue.

Each interference problem is different. You have to try this and then try that until you find a solution. Using the principles outlined here, ferrite beads and toroids can be extremely helpful.

Palomar Engineers

P.O. Box 455, Escondido, Calif., U.S.A.
Phone: (619) 747-3343

Transceiver Preamplifier

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&
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OPERATOR'S MANUAL

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INSTALLATION

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2. Run a coaxial cable from your transceiver antenna jack to the RECEIVER jack on the preamplifier rear panel.

3. P-410X: Plug the power cord into a 117-v 60 Hz outlet. P-412X: Connect red power lead to +12-v DC. Ground rear post.

4. If you use a linear amplifier with the transceiver connect it between the preamplifier and the antenna. The maximum power that can run through the preamplifier is 350 watts peak. So, do not ever connect it to the output of your linear.

OPERATION

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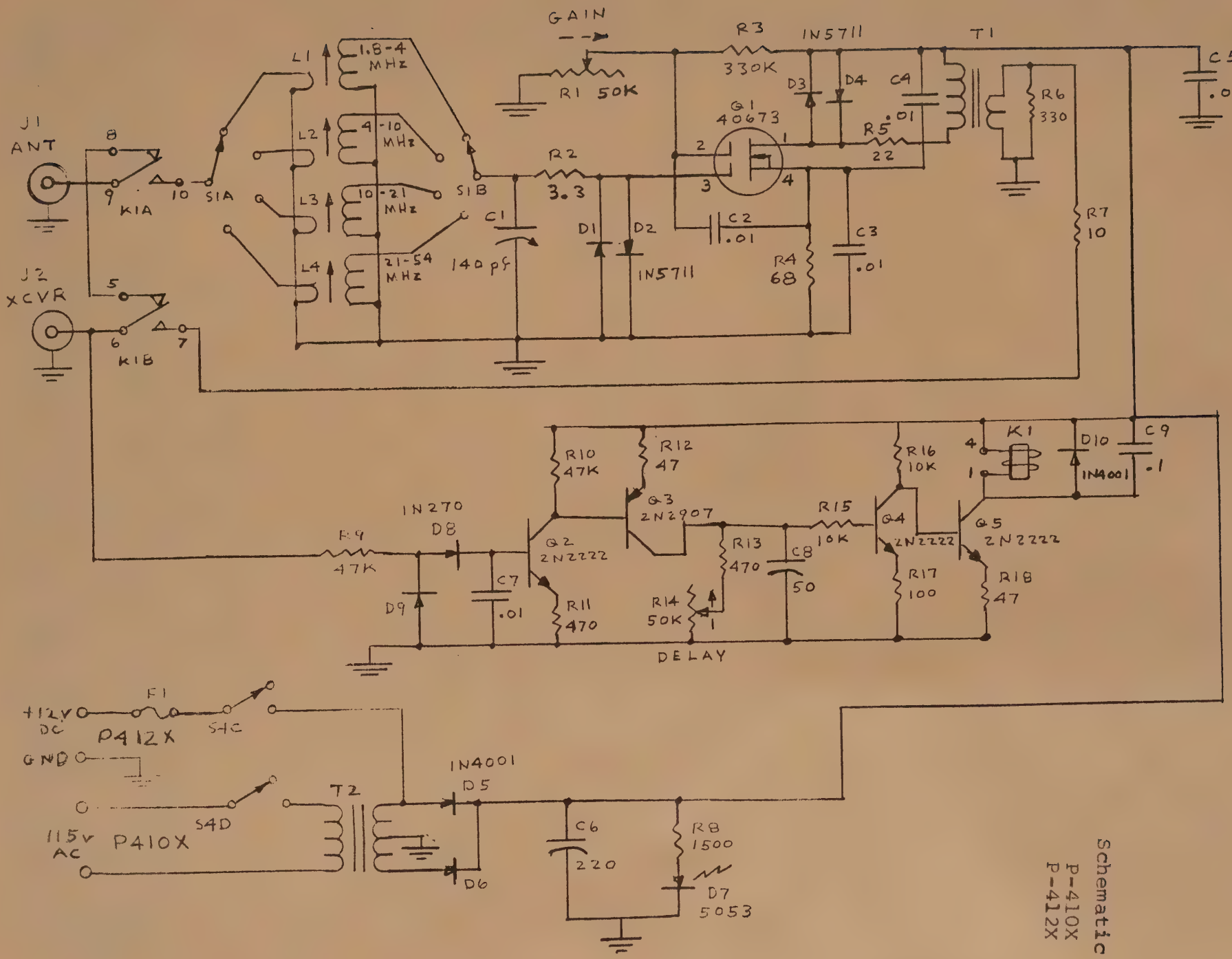

Schematic
P-410X
P-412X

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Palomar Engineers
1924-F West Mission Road, Escondido, CA 92025 • Phone (619) 747-3343

Model PT-340

TUNER-TUNER™

OPERATOR'S MANUAL

PALOMAR ENGINEERS

Installation. Connect the Tuner-Tuner to the transceiver antenna jack and to the TRANSMITTER or TRANSCEIVER jack of the antenna tuner. If you are using an amplifier connect the Tuner-Tuner between the transceiver and the amplifier. Connect a 9-volt transistor battery to the battery strap on the rear of the Tuner-Tuner and slip it into the battery clip. An alkaline battery is best. Turn the panel switch to TUNE position and observe that the panel lamp flashes. Turn the switch to OFF.

Operation. Tune the receiver to the frequency on which you want to operate. Turn off the receiver AGC or watch the "S" meter to see the noise level. Turn on the Tuner-Tuner. There will be a loud noise about S9 on the meter. Adjust your antenna tuner for a null (a drop in the noise). Continue to adjust the tuner until the noise is as low as you can get it. The SWR is now 1:1. Turn the Tuner-Tuner off. If you have a dummy load tune your transmitter using it. Then switch back to your antenna and you are ready to transmit. Everything will be tuned up correctly even though you have not transmitted a signal on the air!

Caution. The basic principle in using the Tuner-Tuner is: DON'T TRANSMIT WHEN IT IS IN TUNE POSITION. The flashing warning light and the clicking noise in your receiver are to remind you that it is turned on. When it is turned off you can put any amount of RF power (up to 3000 watts) through it. Someday you may make the mistake of transmitting when the Tuner-Tuner is turned on. No smoke will come out of it but the noise output will be weak and the null will be at a wrong setting of your tuner. Remove the two black screws on the side of the case and take off the cover. Replace the fuse in the clip on the circuit board. Use an AGX 1/16 amp. fuse. One spare fuse is sent with the Tuner-Tuner. Do not use a heavier fuse as it may not protect the Tuner-Tuner.

Maintenance. The Tuner-Tuner has top quality components including a ceramic switch and stainless steel hardware so it needs only fuse and battery replacement to give many years of reliable service. Battery drain is 35-ma but the operating time is short so battery life is quite long.

Spare fuses
$1 postpaid

SWR is not 1.0 at Tuner-Tuner null. After you get a noise null with the Tuner-Tuner your SWR should be 1.0 but sometimes it is not. There are several possible reasons for this:

1. The fuse is blown. If it is the noise output will be less than usual. You will get a null but it will be in the wrong place. SWR may be as high as 2 or 3. Replace the fuse.
2. It is possible quickly to get a pretty good null but then find that SWR is 1.4, 1.6 or so. This means that the null was not good enough. Try moving one of your antenna tuner knobs slightly past the null. Then adjust the other knob. If you get a better null, do the same thing again. If you get a poorer null try moving the first knob slightly past the null in the other direction. Then adjust the second knob for null.
3. Some SWR meters don't read right. Can happen.
4. Antenna currents on the coax cable can cause both the Tuner-Tuner and your SWR meter to read wrong. If you change the length of your coax and the SWR reading changes, this is quite likely to be the problem. Use a balun or ferrite chokes.

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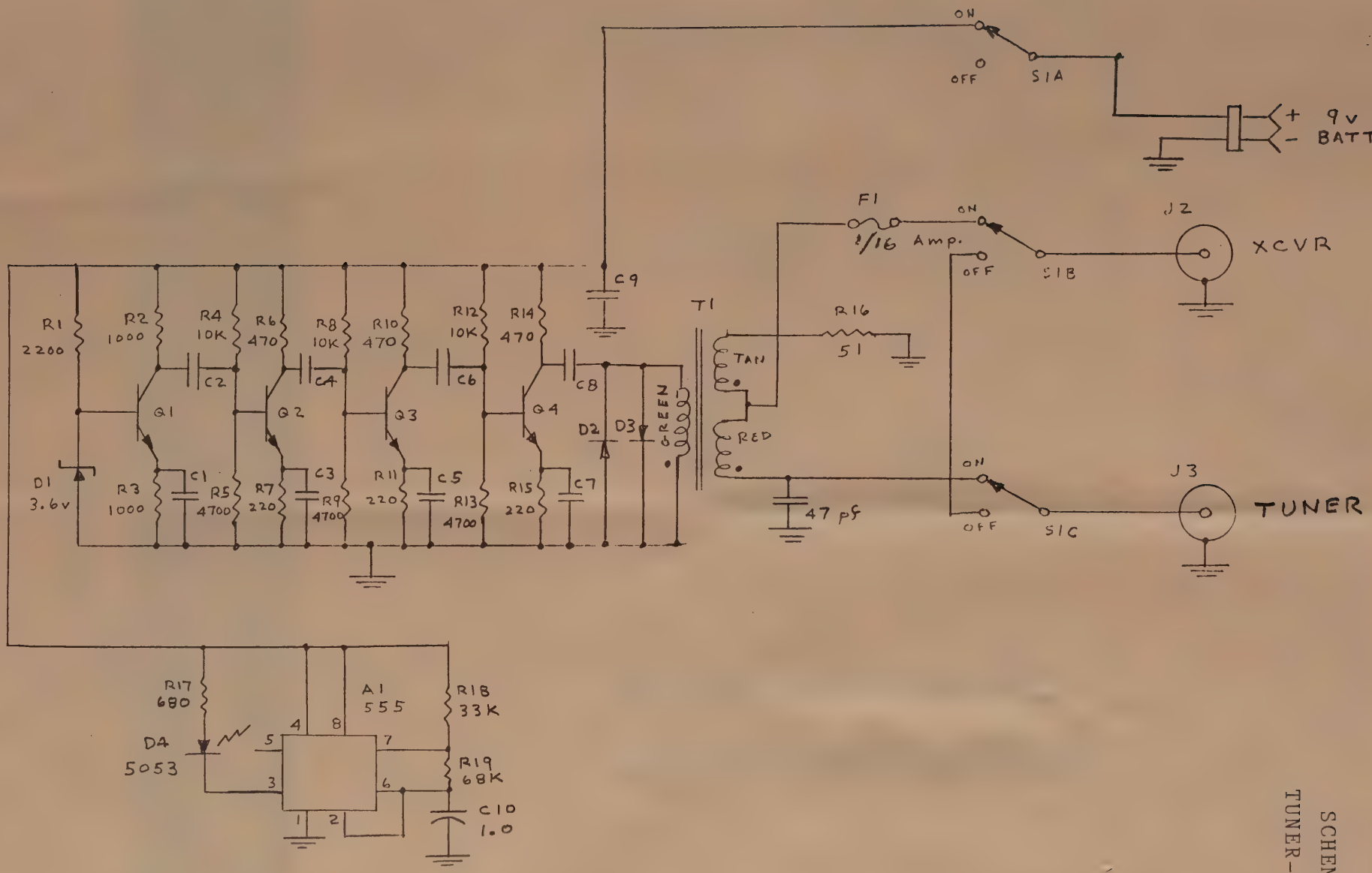

C1-C9 INC. = .1 mfd
Q1-Q4 INC. = 2N5770 OR 2N918
D2-D3 = 1N5711

SCHEMATIC
TUNER-TUNER

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Palomar Engineers

1924-F West Mission Road, Escondido, California 92025 • (619) 747-3343

CAUTION!

Do not turn on transmitter or let VOX turn it on when R-X Noise Bridge is connected to antenna.

R-X
NOISE BRIDGE

OPERATOR'S MANUAL

PALOMAR ENGINEERS

Trap Dipoles. The noise bridge will give a null on each band that the trap dipole resonates. Start with the highest frequency band and measure the resistance and reactance as described for a dipole. Adjust the center (or lower) section if necessary to resonate. Then repeat the procedure on the next lower band. The method works with either horizontal or vertical trap antennas.

Beams. Connect the noise bridge to the driven element. Tune your receiver to the operating frequency and read the resistance and reactance. Adjust the element to resonance if needed.

With the noise bridge still connected to the driven element nulls will be found at the resonant frequencies of the parasitic elements because of their close coupling to the driven element. The correct frequencies for these nulls depends on the exact design of the beam. As an example, the tri-band quad in the ARRL Antenna Book has directors resonant at .980 and reflectors at 1.025 of the driven element resonant frequency.

The impedance chart shows this last relationship with reactance values given for f = 1-MHz. To find the reactance at higher frequencies divide the tabulated values by the frequency in MHz.

Warranty Policy. Palomar Engineers warrants this equipment against defects in material and workmanship for a period of one year from the date of original purchase.

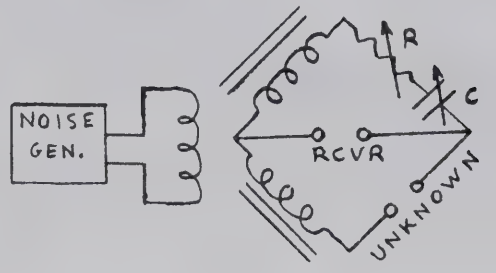
Do not ship to the factory without prior authorization. First write and describe the difficulty. Many times we can diagnose and correct problems by mail.

This warranty is limited to replacing or repairing the defective parts and is not valid if the equipment has been tampered with, misused or damaged.

PALOMAR ENGINEERS
BOX 455 ESCONDIDO CA 92025

R-X NOISE BRIDGE

General Description. The R-X Noise Bridge contains a wideband noise generator and an r-f impedance bridge. Two arms of the bridge are driven equally by the noise generator through a broadband ferrite transformer. A third leg of the bridge has a calibrated variable resistor R and a calibrated variable capacitor C in series. The antenna or other "Unknown" circuit to be measured is connected as the fourth leg of the bridge. A short-wave receiver is used as the detector.



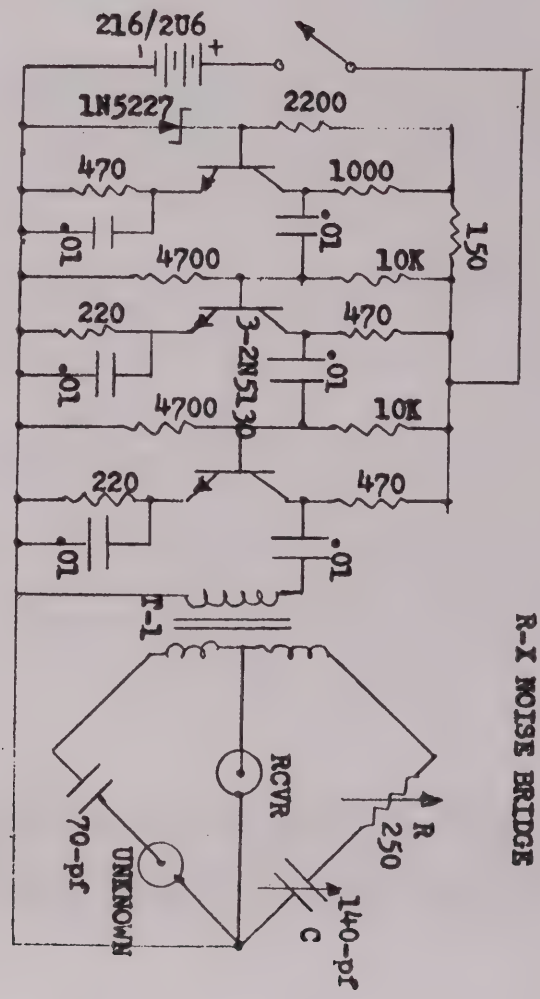
When R and C are adjusted for a null (minimum noise out of the receiver) their dial settings can be read to find the resistance and reactance of the unknown. A capacitor is in series with the unknown so that, if the unknown is a pure resistance, capacitor C is at half scale for balance. Thus both capacitive and inductive impedances can be measured. By tuning the receiver, the R and X of the unknown can be found at different frequencies.

The useful range of the Noise Bridge is 1-100 MHz. It measures R = 0-250 ohms and C = ±70 pf.

Antenna Resonance. Connect the antenna to the "Unknown" terminal, a receiver to the "Receiver" terminal (through any convenient length of line), and a 9-v transistor battery to the clips provided.

Tune the receiver to the expected resonant frequency of the antenna and turn the Noise Bridge on. A loud noise will be heard. Adjust the R and X controls for null; the controls interact and must be adjusted alternately until a deep null is obtained.

If the reading is on the X_L side of zero, the receiver is tuned to a frequency above resonance. If the X reading is on the X_C side of zero, the receiver is tuned



Schematic

R-X NOISE BRIDGE

some measurements. To find the precise setting for a given antenna resistance and to check the calibration of the bridge, resistors of known values can be connected to the "Unknown" terminal. ¼ watt or ½ watt carbon resistors are suitable for this purpose. They should be mounted in a PL-259 coaxial plug as shown below. The plug is then mated with the "Unknown" receptacle of the Noise Bridge.

Resistors connected to the "Unknown" terminal by banana plugs or other open wiring methods invariably will give incorrect X readings because of lead inductance.

Impedance Chart. Refer to the schematic diagram on page 2. R and C are the panel controls labeled R and X. C = 70 pf at a dial reading of X = 0. There is a 70-pf capacitor in series with the unknown. If the unknown series resistance and reactance are R_U and X_U then at null

$$R = R_U \quad \text{and} \quad X_C = X_U + X_{(70\text{-pf})}$$

below resonance. Using the X reading as a guide, retune the receiver and readjust the R and X dials for null. With this procedure it is easy to find the resonant frequency of an antenna.

At the resonant frequency (X = 0) the R reading is the antenna resistance at the measurement point. If the measurement is made at a current loop (the center of a dipole antenna, for example)the indicated resistance is effectively the antenna radiation resistance.

Sometimes it is not possible to make the measurements at the antenna. Instead the R-X Noise Bridge can be connected to the antenna's coax feedline. There are two ways to do this:

1. If the feedline is an electrical half wave long, or some multiple of a half wave, then the readings taken at the end of the feedline are exactly the same as though they were taken at the antenna. Of course there is just one frequency where the feedline is a half wave long so all measurements must be taken at this frequency,

2. If the feedline length is known, readings taken at the end of the feedline at any frequency can be converted using the Smith chart to find the antenna resistance

and reactance. The procedure is described in detail in the ARRL Antenna Book (13th edition, 1974).

Antennas Off-Resonance. With the antenna connected as the "Unknown" its resistance and reactance off resonance can be found. At frequencies lower than resonance an antenna appears as a capacitor and resistor in series. Above resonance it appears as an inductor and resistor in series. The resistance is read directly from the R dial. The reactance is found from the X dial reading and the impedance chart. The chart gives reactance in ohms for a measurement frequency of 1-MHz. To find the reactance at higher frequencies, divide the tabulated values by the frequency in MHz.

Series Tuned Circuits. To find the resonant frequency of a series tuned circuit, connect it across the "Unknown" terminals. Set the R control to minimum resistance (most tuned circuits used in communications work have very low series resistance). Set the X control to zero. Tune the receiver for a null. The X control can be used as described above to determine whether resonance is above or

If it is desired to prune the line to resonance at a given frequency the line should be disconnected from the R-X Bridge. Short the "Unknown" terminal and adjust the X control for a null with the receiver at the desired frequency (the null will be at X = 0 but this method allows a precise setting to be made). Reconnect the line and do not readjust the X control. Find the quarter wave frequency by tuning the receiver to null. Prune the line slightly, retune the receiver, and repeat the procedure until the desired frequency is reached.

The length of a halfwave line is:

$$L_{(feet)} = \frac{492}{f} V$$

To find the frequency for a halfwave line, the far end of the line should be short-circuited (instead of open-circuited as for quarter wave lines). Then follow the same procedure as described for quarter wave lines.

Calibration. The R-X Noise Bridge has wide range controls (0-250 ohms and ±70-pf) to take care of the many uses to which it may be put. Because of this, and because of variations in bridge components, the dials cannot be read as precisely as desired for

With the resonant frequency known and either the standard capacitor or standard inductor in use an unknown inductor or unknown capacitor value can be calculated.

The L/C/F calculator (available for $2 from the American Radio Relay League) finds the answers without the need for arithmetic calculations.

Transmission Lines. The length of a quarter wave line is:

$$L_{(feet)} = \frac{246}{f} V$$

where: f = frequency in MHz
V = velocity factor of the line.

V is approximately 0.66 for coaxial cables, 0.8 for foam dielectric coaxial cables, 0.82 for twin-lead cables.

To find the frequency at which a given line is an electrical quarter wave, connect it to the "Unknown" terminal. Leave the other end of the line open. Set the R dial at zero. Tune the receiver to the expected frequency. If the line is an exact electrical quarter wave, the null will be at X = 0. If the receiver is tuned too low in frequency the null will be on the X_C side. If the receiver is tuned too high, the null will be on the X_L side of zero.

below the frequency to which the receiver is tuned.

Parallel Tuned Circuits. A coupling link of two turns or so should be connected to the "Unknown" terminal. The link is then brought close to the tuned circuit and the procedure described above is used to find the resonant frequency.

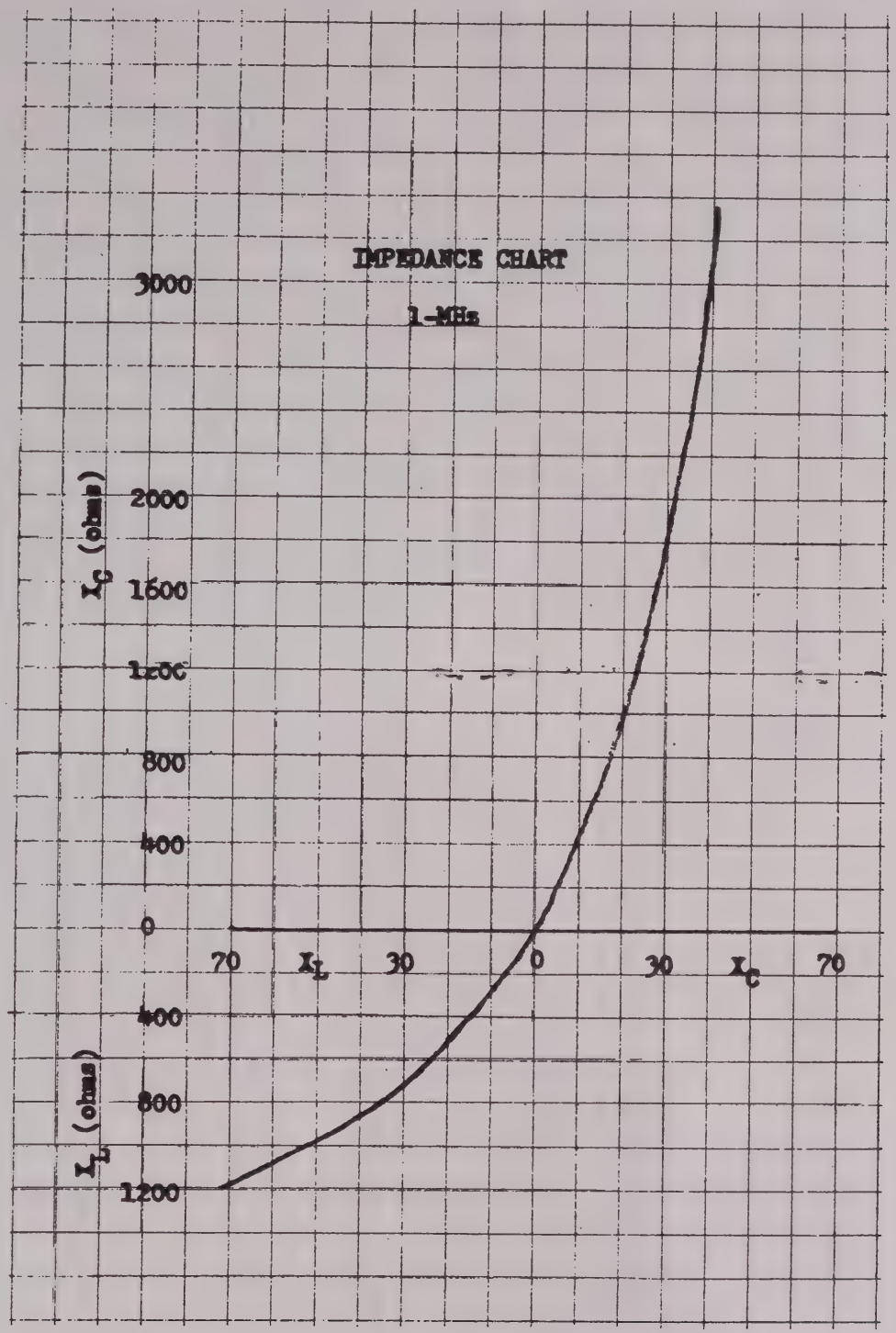
If the tuned circuit uses a toroid inductor, the link must thread through the toroid core.

Measurement of Inductance and Capacitance. The R-X Noise Bridge can be used to find the values of unknown capacitors and inductors. To do this, a standard capacitor (100-pf mica) and a standard inductor (5 microhenry) are used.

To measure the inductance of a coil connect it in series with the standard capacitor and find the resonant frequency. To measure a capacitor, connect it in series with the standard inductor and find the resonant frequency.

$$L = \frac{25,330}{f^2 C} \qquad C = \frac{25,330}{f^2 L}$$

where: f = resonant frequency in MHz
L = inductance in microhenrys
C = capacitance in picofarads


IMPEDANCE CHART
1-MHz
3000
2000
1600
1200
800
400
0
400
800
1200
X_C (ohms)
X_L (ohms)
70
X_L
30
0
30
X_C
70

1399

Transceiver Preamplifier

Model P-410X
&
Model P-412X

OPERATOR'S MANUAL

PALOMAR ENGINEERS

INSTRUCTIONS

All Band Preamplifier

The Palomar Engineers preamplifier may be added to most transceivers in the frequency range 1.8 to 54 MHz. It improves the gain, noise figure, spurious signal and image rejection of the receiver section. This all-new preamplifier has been designed specifically for use with a transceiver. Its sophisticated control circuitry permits it to be added to virtually any transceiver without modification. This is accomplished by the use of automatic antenna switching inside the preamplifier. When the preamplifier senses transmitter RF power, it automatically switches out of the amplifier mode and connects the antenna directly to the transceiver.

The preamplifier uses a tuned RF amplifier, covering all the amateur bands from 160 through 6 meters and, in addition, all foreign broadcasts, as well as other services within this frequency range. It employs a low noise dual gate FET transistor, providing a noise figure of 1.5 to 3.5 db, over the frequency range 1.8 to 54 MHz. The preamplifier will be found especially effective with those transceivers employing the Pi-output network of the transmitter section as the receiver RF stage input. Many transceivers of this type begin to suffer a noticeable decrease in sensitivity on 15 meters, and especially on 10 meters. The preamplifier will be most beneficial on these bands. The inclusion of 6 meters makes it useable with 6 meter transceivers.

INSTALLATION

1. Connect your antenna to the ANTENNA jack on the preamplifier rear panel.

2. Run a coaxial cable from your transceiver antenna jack to the RECEIVER jack on the preamplifier rear panel.

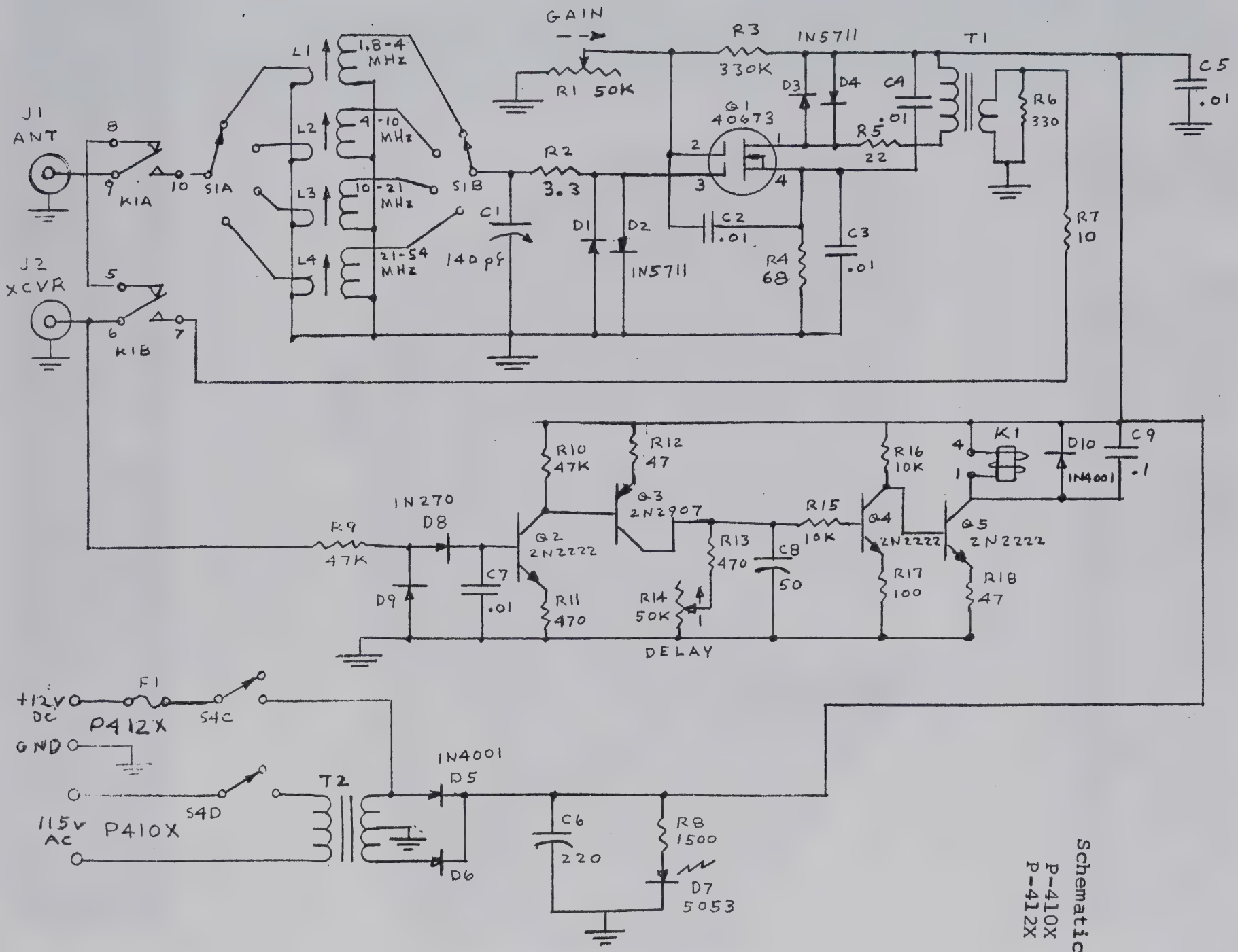
3. P-410X: Plug the power cord into a 117-v 60 Hz outlet.
P-412X: Connect red power lead to +12-v DC. Ground rear post.

4. If you use a linear amplifier with the transceiver connect it between the preamplifier and the antenna. The maximum power that can run through the preamplifier is 350 watts peak. So, do not ever connect it to the output of your linear.

OPERATION

1. After installing the preamplifier as described above, and with the preamplifier power switch in OFF position, the transceiver is connected directly to the antenna. Tune in a signal on the desired frequency band.

2. Turn the BAND switch to a position that includes the desired frequency. Turn the DELAY switch clockwise. Peak the signal with the TUNE control. Set the GAIN control for the desired amplification. The preamplifier is now in operation.


GAIN
R3
330K
IN5711
T1
C5
.01
R1 50K
D3
D4
C4
.01
R6
330
J1
ANT
8
9
K1A
10
S1A
L1
1.8-4 MHz
L2
4-10 MHz
L3
10-21 MHz
L4
21-54 MHz
S1B
R2
3.3
C1
140 pf
Q1
40673
2
1
3
4
R5
22
D1
D2
IN5711
C2
.01
C3
.01
R4
68
R7
10
J2
XCVR
5
6
K1B
7
R10
47K
R12
47
Q3
2N2907
IN270
D8
R9
47K
Q2
2N2222
R15
10K
R16
10K
K1
4
1
D10
IN4001
C9
.1
R13
470
C8
50
Q4
2N2222
Q5
2N2222
C7
.01
D9
R11
470
R14
50K
R17
100
R18
47
DELAY
+12V
DC
F1
P412X
S4C
GND
S4D
115V
AC
P410X
T2
IN4001
D5
D6
C6
220
R8
1500
D7
5053
Schematic
P-410X
P-412X

3. As soon as you start to transmit, the preamplifier cuts itself out of the circuit and the transceiver is connected directly to the antenna. After transmission stops there is a short delay, then the preamplifier cuts back in. The DELAY control sets the delay time. For CW and most SSB work it should be set full clockwise (maximum delay). For contest or net operation a shorter delay may be desired. The delay is continuously adjustable from about ½-second to over 3-seconds.

Palomar Engineers

1924-F West Mission Road, Escondido, CA 92025 • Phone (619) 747-3343

Here's the new

PALOMAR ENGINEERS

IC KEYER

Attractively styled gray color scheme matches most modern equipment

Yes. Built-in power supply for 115-v 60-Hz.

- **Self Completing**
  Fully automatic character forming.
- **Dot Memory**
  Easy to use. Squeeze feature.
- **Keyed Time Base**
  Instant start. 5-50 wpm.
- **Built-in Key**
  Famous Brown "feather touch" action.
- **Sidetone Oscillator**
  Mixed with receiver. Self-contained speaker.
- **Relay Output**
  Heavy silver contacts. High voltage. No polarity problem.

The IC Keyer uses integrated circuits to form dots, dashes and spaces at speeds from 5 to 50 wpm. The digital nature of its circuit gives the characters perfect weighting at all speeds. There are no adjustments to drift. Dots and dashes are self completing. Speed is instantly adjustable by a front panel control which also has a hold (key-down) position for transmitter tuning.

The dot memory makes operating easier for beginner and old-timer alike. Normally, if the dot lever is pressed during a dash or during the space following a dash, the dot will be lost. The dot memory prevents this by remembering that the dot lever was closed. The keyer will complete the dash, complete the space, and then send a dot.

The built-in key features the famous Brown "feather-touch" action. It is fully adjustable for contact spacing and key pressure. Its effortless action has made it a favorite with CW operators everywhere.

The audio section of the Keyer has a sidetone oscillator, a mixer-amplifier and a built-in speaker. The output of the station receiver can be mixed with the sidetone and the two monitored on the speaker or on headphones plugged into the rear panel jack. Sidetone volume is controlled from the front panel.

The built-in power supply operates from 115 volts 50/60 Hz.

Transmitter keying is through a sensitive relay with silver contacts. It will key 300 volts (either polarity) at 100 milliamperes. At low voltage the contacts will handle up to 1 ampere. The relay completely isolates the keyer circuitry from the transmitter and will handle high transient overloads without damage. Details on arc suppression and connection to transceivers are in the complete instruction manual supplied with each keyer.

The smartly styled two-tone grey cabinet matches most modern equipment. Case and chassis are of heavy-gauge aluminum. The solid weight of the keyer with its neoprene feet prevents "walking" at high speeds.

The IC Keyer makes a durable and attractive addition to any amateur station. Its advanced design makes it a lasting value at lower cost than other keyers with comparable features.

Front Panel Controls

Speed - Continuously variable 5-50 wpm. Hold position for transmitter tuning.

Volume - Controls sidetone oscillator through self-contained speaker and through headphone jack. Power on-off switch.

Key - Precision Brown dual-paddle mechanism.

Rear Panel Connections

Inputs a. Receiver audio
b. Station ground
c. Line cord. For 115-volt 50/60 Hz line.

Outputs a. Key contacts rated 300-v @ 100-ma. Floating. Non-polarized.

b. Phone jack. Sidetone signal and mixed receiver audio for headphones.

Cabinet

Size 3 x 5½ x 7 inches. Aluminum in two-tone grey finish.

Price

$77.50 postpaid in U.S.A. (Calif. residents add 5% sales tax).

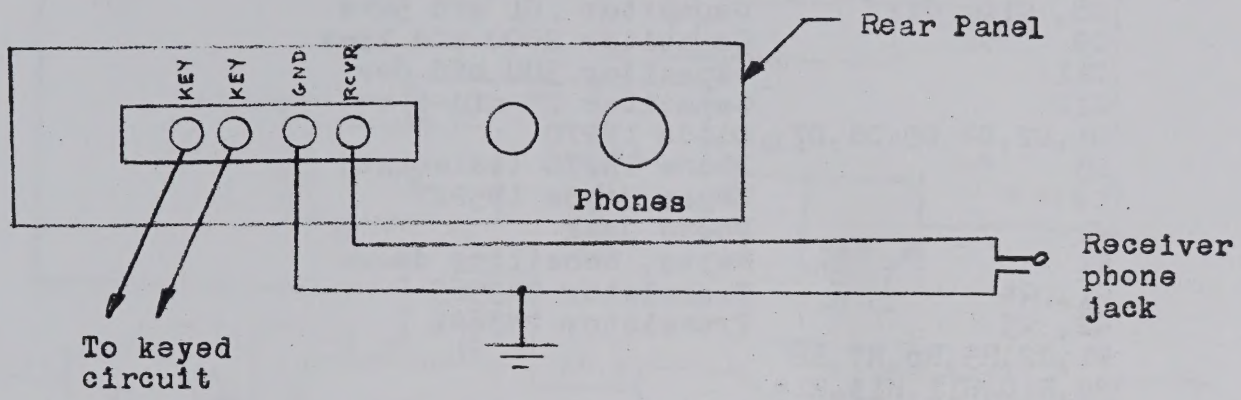
Send check or money order to:

PALOMAR ENGINEERS

Box 455 Escondido, Calif. 92025

IC KEYER - Instructions

Installation. Connections to the keyer are made to a terminal strip on the rear panel. Wiring is shown in the drawing below.



The IC Keyer is for operation on 115 volt 50/60 Hz ac only.

Connect the transmitter to the two "key" terminals. The terminals are floating and it does not matter if the transmitter key leads are grounded or not. However they should not be more than 500 volts above ground.

The keyer contacts are rated at 300 volts and 100 ma. At lower voltages higher currents can be keyed. If there is a large capacitor in the keyed circuit the transient currents may cause the keying relay contacts to stick.

For example, the Swan 500 transceiver requires a 1000 ohm resistor in series with one keying lead. A ½ watt or ¼ watt resistor will do. Other grid-block keyed transceivers may also require a resistor to reduce the inrush current.

A simple test is to key the transmitter with a hand key in a darkened room. If heavy arcing is present it should be eliminated.

If you wish to monitor your keying while listening to the receiver, connect the "rcvr" terminal (and a ground lead) to the receiver headphone jack. The mixed audio can then be heard on the keyer's speaker or on headphones plugged into the rear panel jack.

The ground terminal should also be connected to the station ground. This puts the keyer cabinet and the key arm at ground potential.

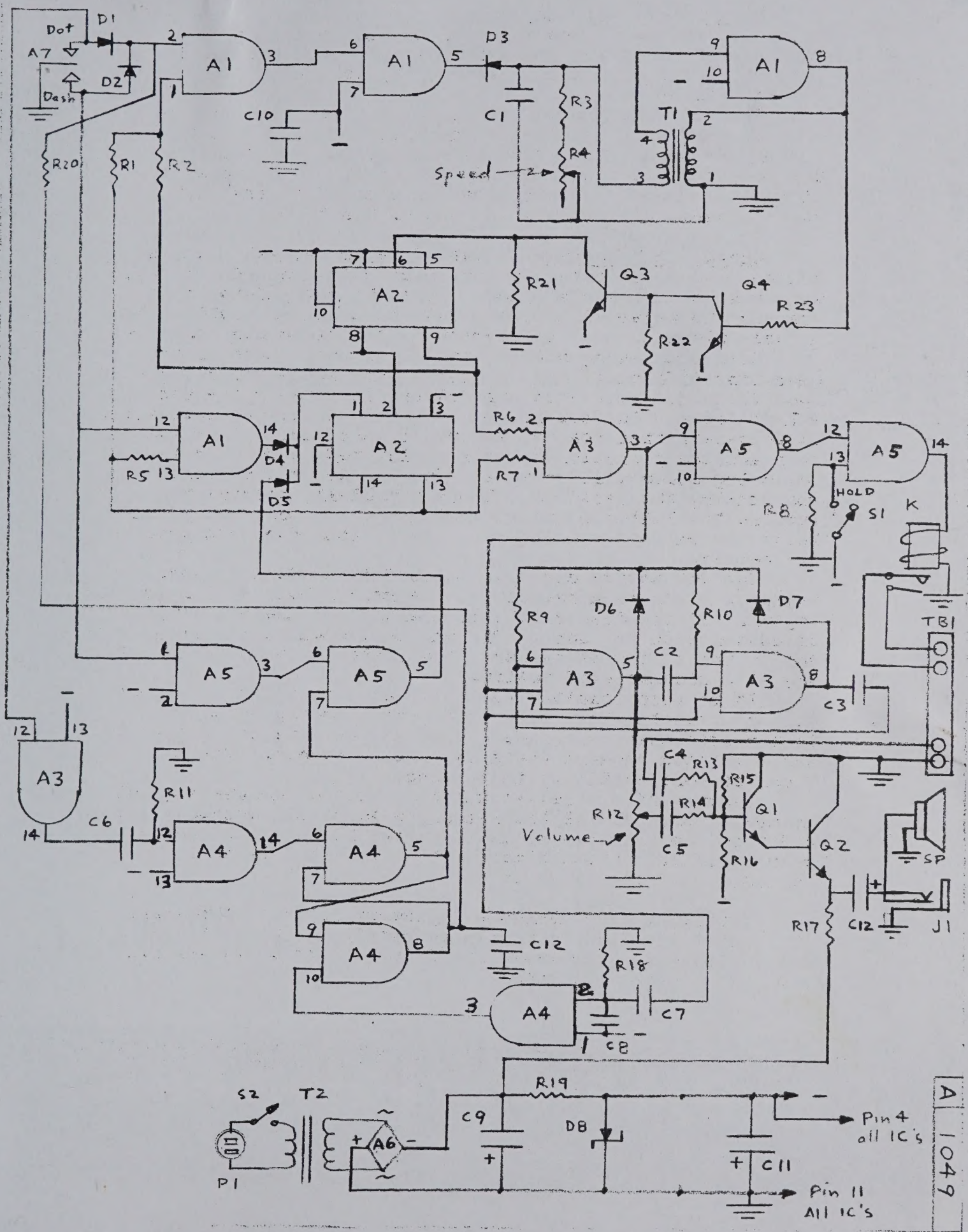
Operation. Turn the front panel volume control fully clockwise. Turn the speed control half way up. The keyer should now operate.

Any speed from 5 to 50 wpm can be selected by the speed control. If this control is turned counterclockwise until the switch clicks, the keyer will stay on continuously. Use this "hold" position for transmitter tuning.

Turning the volume control fully counterclockwise turns the keyer off.

Parts List

A1, A3, A4, A5	Quad 2-input gate
A2	Dual JK Flip-Flop
A6	Bridge Rectifier
A7	Key
C1	Capacitor, mylar .33 mfd 100-v
C2,C3,C5	Capacitor .1 mfd 10-v
C4	Capacitor .1 mfd 100-v
C6,C7	Capacitor 1 mfd 3-v
C8, C10, C12	Capacitor .01 mfd 50-v
C9	Capacitor 2000 mfd 15-v
C11	Capacitor 500 mfd 6-v
C12	Capacitor 25 mfd 6-v
D1,D2,D4,D5,D6,D7	Diode 1N270
D3	Diode 1N270 (selected)
D8	Zener diode 1N5227
J1	Phone jack
K1	Relay, sensitive dc
Q1, Q4	Transistor 2N3565
Q2, Q3	Transistor 2N3642
R1,R2,R5,R6,R7,R8 R9,R10,R11,R13,R14 R20,R22,R23	4700 ohm ¼w 10%
R3	68K ohm ¼w 10%
R4	Potentiometer 1-Meg
R12	Potentiometer 2500 ohm
R15	47K ¼w 10%
R16,R18	22K ¼w 10%
R17	68 ohm ¼w 10%
R19	15 ohm ½w 10%
S1, S2	SPST (S1 on R4, S2 on R12)
T1	Transformer, audio #85-1
T2	Transformer, power #86-1


Dot
Dash
A7
D1
D2
A1
A2
A3
A4
A5
A6
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
D3
D4
D5
D6
D7
D8
T1
T2
Q1
Q2
Q3
Q4
Speed
HOLD
S1
S2
K
TB1
SP
J1
P1
Volume
Pin 4
all IC's
Pin 11
All IC's
A
1049

Adjustment. The key tension adjustment is on the front of the key on the right side. Loosen the nut and turn the screw in for stiffer action, out for lighter action. After adjusting to suit, tighten nut to lock the adjustment.

The key movement is set at the factory. However, both dot and dash paddles are adjustable. The adjustment screws are behind the front panel. To get at them remove the four cabinet feet. Then press on the front panel with both thunbs where it says "Palomar Engineers". The keyer chassis will then slide out of its case.

Operating Procedures. The IC Keyer has self-completing action. That is, once the dash paddle is pressed the keyer will make a dash and a space. Once the dot paddle is pressed the keyer will make a dot and a space. Unlike a semi-automatic key the characters cannot be run together.

Self-completing action, by itself, can cause some operating difficulty. If a dash or the space following a dash is in progress when the dot key is pressed the dot will be lost. The dot memory in the IC Keyer prevents this. It remembers that the dot key was pressed and, after the dash and the following space are finished, a dot and its following space will be made. This action can be observed when making the letter N. It is especially helpful when forming the letter C which probably is the most difficult letter to make on an electronic keyer that does not have dot memory.

The dot memory can also be used to perform "squeeze keying". This is a method used to reduce hand motion in keying. If the dash paddle is pressed to make a string of dashes then the dot paddle can be tapped to insert a dot in the string of dashes. The letter Q can be sent this way with minimum hand motion.

It is also possible to insert a dash into a string of dots by pressing the dash paddle while making dots. The dash paddle must be closed after the previous dot and space are completed because there is no dash memory. The letter F can be sent easily by this method.

Because of the self-completing action and the digital nature of the circuit the weighting is always exact. That is, a dot is the same length as the space between dots and a dash is exactly three times that long. This is true regardless of keying speed.

Problems? Each Palomar Engineers keyer is carefully checked at the factory before shipment. If there is any difficulty with your keyer or if it is damaged in shipping write the factory at once.

PALOMAR ENGINEERS

Box 455 Escondido, Calif. 92025